1. On some Points in the Anatomy of the Great Anteater (*Myrmecophaga jubata*). By W. A. Forbes, B.A., Prosector to the Society.

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(Plate XV.)

The literature relating to the anatomical structure of the Edentata, though very considerable, is unfortunately much scattered, and with many blanks as regards special points. The genus *Myrmecophaga* may be considered—thanks chiefly to the labours of Owen[1] and Pouchet[2], who have elaborately described many parts of its organization—to be the best known, as regards anatomical structure, of all the existing Anteaters. Two adult female specimens of this animal having lately[3] passed through my hands in my prosectorial capacity, I have had the opportunity of confirming a large part of the already published accounts of its anatomy, as well as of correcting, or adding, certain details, which I now lay before the Society.

1. *Alimentary Canal and Appendages.*—The palate (fig. 1, p. 288) is not absolutely smooth, but presents anteriorly a series of irregular transverse ridges notched along their margin, best developed and nearly meeting mesially anteriorly, posteriorly becoming much more oblique backwards and less regular, the ridges not being opposite each other but more or less alternating. In all there are about seven of these ridges. The floor of the mouth to about 2 inches beyond the most posterior opening of the submaxillary glands, the gums over the tip of the lower jaw, and the lateral callous pads which are present as in *Tamandua*, are all covered with minute, retroverted, closely-set papillæ.

[1] "On the Anatomy of the Great Anteater," Part I., Trans. Zool. Soc. iv. pp. 117-140, pls. xxxvii.-xl.; Part II., *l. c.* pp. 179–181, pls. li.–liii.

[2] Mémoires sur le Grand Fourmilier: Paris, 1874.

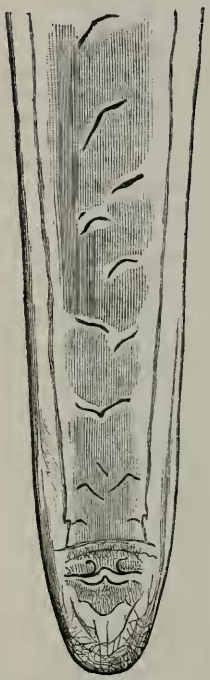
In addition to these, there are brief references to *Myrmecophaga jubata* in Rapp's 'Edentaten' (2e Aufl., Tübingen, 1852), and Prof. Flower's Hunterian Lectures (Med. Times and Gazette, Nov. 30, 1872, p. 591). The submaxillary glands have been described by Gervais (C. R. lxix. pp. 1110, 1111 [1869]); and the brain by the same author ("Mémoire sur les formes cérébrales propres aux Edentés vivants et fossiles," Nouv. Arch. Mus. v. pp. 1–56, pls. i.–v.), and by G. Pouchet ("Mémoire sur l'encephale des Edentés," Robin's Journal de l'Anatomie, 1868, pp. 658–675, and 1869, pp. 1–18, &c.).

[3] The first of these, from Buenos Ayres (spec. *d* of the List of Vertebrates), was presented to the Society by the Hon. L. S. Sackville West (now H. B. M's. Minister at Washington) on Sept. 7, 1877. It died Nov. 29, 1881, from severe inflammation of the connective tissues lying in and around the submaxillary glands.

The second (specimen *a*) was presented so long ago as October 4, 1867, by Dr. J. A. Palin, C.M.Z.S., and, after living for more than 14 years in the Society's Gardens, died on the 5th of February of the present year. The only disease detected in it, on *post mortem* examination, was a considerable enlargement of the thymus gland, and acute inflammation of the laryngeal mucous membrane. This second specimen, though an aged animal, was by no means so large as the first, having a total length of 6 ft. 1½ in. (from the tip of the nose to the end of the tail, which was 2 ft. 4 in. long), as against 7 ft. 5½ in. in the other.

The tip of the tongue is quite glabrous and globular; but the greater part of the rest of its extent, anterior to the pair of circumvallate papillæ, is dorsally and laterally covered with similar, but smaller, retroverted papillæ, best developed towards the tip of the organ, and gradually getting smaller and smaller towards its base, till they are scarcely visible to the unaided eye except in certain lights. There is a median glabrous line, or shallow groove running along the

Fig. 1.



Palate of *Myrmecophaga jubata*; from a preparation in the Museum of the Royal College of Surgeons, prepared from specimen *a*.

tongue till near its apex; but this is ventral in position. According to Owen there is a similar dorsal one; but if so, it is not very evident (*l. c.* p. 129). The dorsal surface, however, is slightly fluted towards the apex. In front of the circumvallate papillæ a slightly raised median longitudinal ridge extends for some 5 inches.

My observations on the salivary glands agree well in most points

with those of my predecessors, except as regards the number and openings of the ducts to the submaxillary glands, regarding which very different statements have been made at various times. Of these, Gervais's description, as given in some remarks accompanying the exhibition before the French Academy of Sciences of some models of these glands (C. R. *s. c.*), agrees best with my observations. He says:—"*Deux paires* des canaux dont il s'agit viennent aboutir séparément dans la bouche en se rendant a deux poches situées auprès de la symphyse mentonnière; la *troisième* paire verse un peu en arrière, également dans une petite dilatation terminale."

A similar arrangement is described by J. Chatin in the genus *Tamandua*[1], except that he says that there are *two* openings on *each side* at the symphysis. Pouchet, on the other hand, maintains ('Mémoires' &c. pp. v and 88) that there are only *two* ducts on each side, one of these being formed by the confluence of two of the three primary ducts coming from the corresponding three lobes of which each gland is composed. He only describes a single pair of openings close to the symphysis. Owen, finally, describes the three ducts of each side as eventually uniting, and opening, also by a single aperture, close to the symphysis.

An examination, however, of his specimen (now preserved in the Hunterian Museum, where, by the kind permission of Prof. Flower, I was allowed to examine it), demonstrates the existence of a second pair of apertures in the floor of the mouth situated some 2 inches behind the first pair, which lie immediately behind the symphysis, in this respect quite agreeing with Gervais's description, and with my own observations on the second of my (fresh) specimens (*vide* Plate XV. fig. 3 *c*). This second pair of apertures, which lie close to each other on each side of the median line and are very minute, are the openings of the deeper ducts, which, one on each side, arise from the more anterior (*cervical*) portion of the gland[2]. As these lie quite behind the other pair of apertures, any injection passed into the latter can of course only fill the two pairs of ducts (*a*, *b*) which debouch into them. This may easily explain, therefore, Pouchet's only having found *two* ducts on each side, though it is possible that individual specimens may vary in this respect. I must at least notice that in the first specimen that passed through my hands (the submaxillary ducts of which were injected from the anterior pair of apertures alone), I found on the left side a *single* duct only, and on the right *two*, which united together at about the level of the articulation of the lower jaw. This specimen, however, had, it is to be remembered, extensive inflammation in these parts, which may possibly have effected an alteration in the relations and number of the ducts. It is pretty clear, however, that three pairs all together is the ordinary number of these ducts,

[1] Ann. Sci. Nat. 5, (Zool.) xiii. art. no. 9.

[2] Such was, at least, the condition in the only specimen of *Myrmecophaga* in which these ducts had been satisfactorily injected examined by me. In *Tamandua*, according to Chatin's figure (*op. cit.* pl. 14), it is the ducts from the posterior (*sternal*) part of the gland that open here. This point requires re-examination, as also the number of apertures anteriorly.

that having been found in Gervais's specimen (perhaps in two), in Owen's, and in one of mine for certain.

I found the opening of the two other ducts exactly as described by Pouchet (*l. c.* p. 89) and Gervais, one of these being dilated terminally, the dilatation receiving the other duct and opening by a *single* aperture into the mouth (*vide* Plate XV. fig. 3).

At the point where the three submaxillary ducts of each side, coming from the three lobes of the gland, converge, and become united intimately by their walls to each other, they become surrounded by a bulb-like mass of muscular issue, the exact relations of which I shall describe below. But I could not perceive that this structure, which externally looks like a bulbous reservoir surrounded by a muscular coat, corresponded to any dilatation of the ducts which pass through it; on the contrary, these seem to preserve a nearly uniform diameter throughout this part of their course, a condition corresponding to that described by Chatin in *Tamandua*.

The terminal reservoirs, I may add, of the two pairs of submaxillary ducts lie just above the long thin median tendon of the genio-hyoid, the contraction of which muscle may possibly, by compressing the floors of these reservoirs, aid in the ejaculation of the fluid contained in them.

The stomach of *Myrmecophaga* generally resembles Prof. Owen's figures and description; but the thick pyloric pads are softer and more vascular, and the whole less gizzard-like, than I had been led to anticipate from his account. The gyriform folds of the mucous membrane of the cardiac part of the stomach, which quite resemble those of the stomach in many other animals, are, in particular, not happily represented in his fig. 1, pl. lii.

The liver of both specimens agrees very well with Prof. Flower's description of this viscus. Both caudate and Spigelian lobes are practically absent.

As accurately described by Pouchet ('Mémoires,' pp. 191, 192), the pancreatic duct ends in a vesicle, in the walls of which the hepatic duct runs for a little way and then opens into it, the vesicle then opening by a separate aperture into the duodenum.

In the first (larger) specimen examined by me the intestines measured as follows:—small intestine 24 ft. 10 in., large intestine 2 ft. $3\frac{1}{2}$ inches. The cæcum can hardly be said to exist as a separate part. The median longitudinal ridge of mucous membrane was continuous for the posterior 15 feet 3 inches of the small intestine, and reappeared above this at intervals in a less regular and less developed way.

I could see no *longitudinal* folds of mucous membrane, such as are described by Owen, in the rectum, which, however, had distinctly *transverse* ones, irregularly disposed in a gyriform way, well marked.

The right lung is trilobed, with an azygos lobe superadded; the left lung is bilobed, the lowest lobe in each lung being biggest.

The kidneys are quite smooth externally: there are no distinct Malpighian pyramids, the tubules opening internally on a single

slightly-elevated ridge, which in one specimen is divided into three or four slightly-marked papillæ.

2. *Brain.*—The late Prof. Gervais has given, in his memoir on the brain of Edentata, figures of the superior, inferior, and lateral aspects of the brain of *Myrmecophaga jubata*, as well as of the cranial casts of that and the other species of Anteater[1]. Pouchet, in his 'Mémoires,' also gives figures of the cranial casts of *Myrmecophaga*, and, in the article in the 'Journal de l'Anatomie' above cited, representations of the brain itself of *Tamandua* and *Cycloturus*, that organ having been previously figured in the latter species by Tiedemann[2].

As I find Gervais's figures of the brain in some respects unsatisfactory, I have taken this opportunity of giving representations of the brains extracted from my two specimens, including one showing the disposition of the deeper parts (figs. 2, 3, 4, pp. 292, 293).

The olfactory lobes are very large, projecting forwards for ·7 inch in front of the cerebral hemispheres: in the lateral view of the brain they occupy, at least anteriorly, almost the lower half of the parts there exposed. They are continuous basally with the well-developed "hippocampal lobe," in front of which appears a large oval swelling of grey matter, on the middle root of the olfactory lobe, of an antero-posterior extent of more than half an inch. Towards their base, the olfactory tracts are curiously marked by slight transverse impressions (fig. 3) giving them a striated appearance, which may also be observed in the corresponding regions in the brains of *Tamandua* and *Orycteropus*. The cerebral hemispheres are but little arched superiorly[3]; but the *vermis cerebelli* is very prominent, rising above the general level of the hemispheres (fig. 2). Viewed from above, the hemispheres appear somewhat truncated posteriorly, though they here completely conceal the *corpora quadrigemina*, abutting on the cerebellum (fig. 2). Attaining their greatest breadth anterior to this, a little in front of the level of the posterior end of the median fissure (1·95 inch long), they taper somewhat rapidly anteriorly.

The cerebellum is well convoluted, with its lateral extent (1·5 inch) greater than its antero-posterior (1·15). The vermis is much narrower than the lateral lobes; it is prominent, and in one specimen (the larger) considerably twisted on itself. The flocculi are distinct.

The nates are much larger than the testes: the latter are very narrow from before backwards as compared with their combined transverse extent (·075 : ·6 inch), and are not distinctly separated from each other. The nates are larger, more prominent, and distinctly paired, being separated by a well-marked constriction; they are somewhat triangular in shape, with their longer axis transverse.

[1] Nouv. Arch. v. pl. i. figs. 3, 3*a*, 3*b*, pl. ii. figs. 1–3.

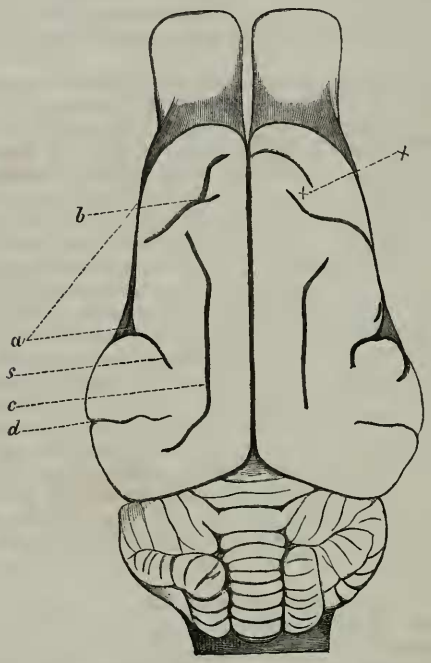
[2] Icones cerebri Simiarum, pl. v. fig. 8.

[3] Gervais's figure, *l. c.* fig. 3*a*, makes their outline much too convex antero-posteriorly.

The pineal gland has a distinct hard mineral deposit; its peduncles are easily made out.

There is no very distinct *corpus mamillare*, it being only represented by a white swelling on the infundibulum. The *hypophysis cerebri* is very large. The anterior commissure is distinct, but not particularly

Fig. 2.



Brain of *Myrmecophaga jubata* (specimen *a*) from above.

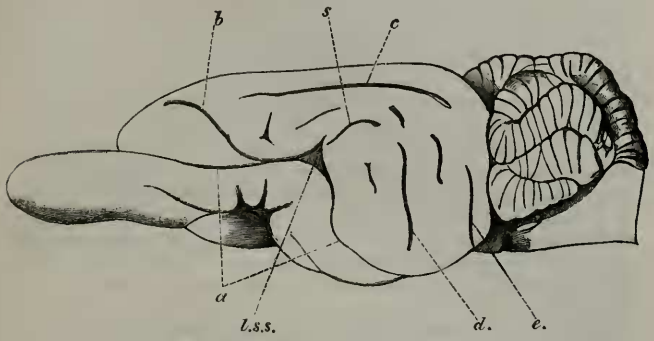
large, its antero-posterior extent being ·15 inch. The soft commissure is very large (·25 inch long); the posterior distinct. The third nerves are small, the optic not large.

There is a good septum lucidum (·25 inch deep anteriorly), with a contained fifth ventricle. The fornix is very well developed, with but few precommissural fibres. The corpus callosum is very well developed, more than an inch long, and nearly horizontal in position, with but a slight *genu* anteriorly. Posteriorly it forms, with the fornix, a prominent pad (*bourrelet*).

The cerebral sulci are not exactly alike in my two specimens, the brain of the bigger of the two animals, though of the same dimen-

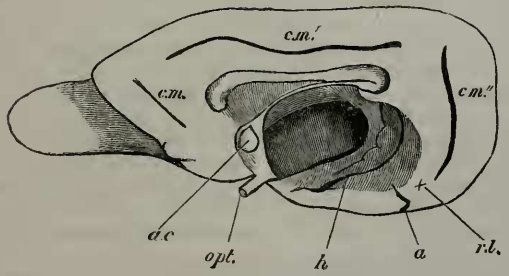
sions as its fellow, being more richly convoluted by the development in it of minor fissures and impressions not present in the other. It is that of which the lateral and internal views are here figured (figs. 3,

Fig. 3.



Brain, from the side, of specimen *d*.

Fig. 4.



The same, from the inside. All these figures are of the natural size.

a, Limbic fissure, inferior arc of (Broca); *b*, fissure of Rolando (Broca); *c*, primary parietal sulcus; *d*, *e*, additional sulci of circumsylvian gyrus; *s*, fissure of Sylvius; *l. s.s*, island of Reil (*lobule sous-sylvien*, Broca); *c.m*, *c.m'*, *c.m''*, calloso-marginal sulcus (superior arc of limbic fissure, Broca); *h*, hippocampal sulcus; *a. c*, anterior commissure; *opt*, optic nerve; *r.l* (fig. 4), "Pli de passage rétro-limbique" (Broca); + (fig. 2), bridging convolution between frontal and parietal lobes.

4): the description of the main sulci is taken from the simpler specimen (represented in fig. 2), but applies in all essential respects to both.

The olfactory lobe is separated from the cerebral hemispheres

above by a shallow fissure (*a*), which, at the level of the anterior extremity of the prominent "hippocampal lobe," turns downwards, and runs along the external and inferior face of that lobe till it terminates on its inner face (fig. 4, *a*), not, however, reaching the hippocampal sulcus (*h*). At the point where its downward course commences there is a small triangular area (*l. s.s.*) exposed on the lateral surface of the brain, from which a short curved shallow sulcus (*s*) runs a short way upwards, forming with the descending part of *a* a forwardly-convex curve. In the larger specimen figured (fig. 3) this short upwardly-running sulcus (*s*) is separated, as will be seen, by a narrow bridging fold from the triangular depression and its posterior continuation (*a*). From the antero-inferior angle of this triangular space, but separated by a very narrow, more or less deep, bridging convolution from *a*, another sinuous fissure (*b*) runs forwards and upwards to terminate near the anterior angle of the hemisphere[1]. Above, on the supero-lateral aspect of the brain, and nearly parallel with the median longitudinal fissure, is a distinct longitudinal sulcus (*c*), convex upwards, which runs in an antero-posterior direction for a space of 1·2 inch.

Finally, parallel with the posterior edge of the hemisphere, dividing the external surface of this "temporal lobe," is a vertically-directed sulcus (*d*) about ·75 inch in extent.

On the internal aspect of the brain (fig. 4) runs a well-marked "calloso-marginal" sulcus (*c.m*), broken up into three or more parts, the most posterior being nearly vertical in position, and separated by but a little space from the posterior extremity of fissure *a*. In its usual position is a well-marked hippocampal sulcus (*h*), with a broad "*fascia dentata*" between it and the *corpus fimbriatum*, the *fascia dentata* being continued, as described by Prof. Turner in *Dasypus*[2], as a thin layer of longitudinally-disposed fibres over the *corpus callosum* to near its *genu*. The hippocampal sulcus does not extend as high as the *corpus callosum*. The lateral ventricle is fair-sized: I can see not a trace of any posterior cornu. The *hippocampus major* is strongly convex. The "hippocampal lobe" has, on its inferior aspect, a few irregular dentations developed near its antero-internal angle.

In the smaller and simpler brain of *Tamandua* (represented diagrammatically in fig. 5, p. 295), the only sulci present are those corresponding to *a*, *b*, *c* in the larger species, with some slight representatives of *d*.

Adopting the late Prof. Broca's ideas[3] as to the nature and composition of the "*scissure limbique*," the inferior arc of this is clearly represented by the fissure *a*, which is separated by a narrow "*pli de passage rétro-limbique*" (fig. 4, *r.l*) from its superior arc, represented

[1] In the smaller specimen (fig. 2), this fissure is, on the right-hand side only, broken up into two by a narrow bridging convolution (+).

[2] Journ. Anat. Phys. i. p. 314 (1867).

[3] "Anatomie comparée des circonvolutions cérébrales. Le grand lobe limbique et la scissure limbique dans la série des Mammifères," Revue d'Anthropologie, vii. pp. 385–498.

by what we commonly call the "calloso-marginal sulcus" (*c.m*, &c.). The slight sulcus at *s*, developed above the triangular depression, will accordingly be the Sylvian fissure. *b* is then, following Broca's identifications, the fissure of Rolando, the gyrus lying anterior to and below it being the reduced equivalent of the frontal lobe. As has already been pointed out, this gyrus is connected posteriorly by a small, sometimes deep, bridging fold with the triangular space (*l. s.s.*) below the Sylvian fissure. This triangular space is Broca's "*lobule sous-sylvien*," its equivalent in the Primates being the lobe of the island of Reil (*l. c.* p. 430).

The longitudinal sulcus *c* corresponds probably to Broca's "*sillon pariétal primaire*;" the gyrus above and internal to it will thus be the "*circonvolution sagittale*," that below it the "*circonvolution sylvien*," which in the more-convoluted of the brains figured (fig. 3) becomes divided up by smaller sulci (*d*, *e*, &c.) into a number of imperfect gyri.

Fig. 5.

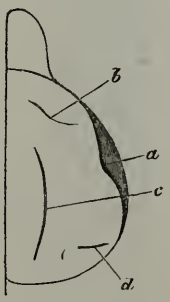


Diagram of right cerebral hemisphere of *Tamandua tetradactyla*, from above.

From my study of the brains of the remaining genera of Edentata, I have little doubt that the sulci *a*, *b*, and *c*, here described, can be traced, with various modifications, in nearly all the members of this group. *Orycteropus* in its cerebral characters seems to approach *Myrmecophaga* more nearly than any other form, the sulci and gyri of the brains of the two forms, as well as their general conformation, being very similar; *Manis* seems to possess the three typical sulci well developed; and these are also present in the larger Dasypodidæ, though apparently much reduced in the smaller forms of that group. The Sloths conform to the same general type. But, in the absence of a larger series of brains of this group than is at present available for comparison, satisfactory generalization on this subject is impossible, most of the published figures of Edentate brains being very unsatisfactory in detail, whilst nothing of importance is known as regards the develo pment of the sulci in any member of this group.

3. *Female Generative Organs* (fig. 6, p. 297).—These have been briefly described by Pouchet[1], as well as by Rapp; but their accounts will, in some respects, bear supplementing.

A cloaca, in the true sense of the word, is not present in the Great Anteater. The *labia majora*, which bound the vertical urino-genital fissure, are very prominent and hirsute. Above them, but separated by a distinct perineal space, slightly hair-clad, is the transverse anal aperture, the mucous membrane lining which is pink, quite different from that of the lower passage and its boundaries, which is grey. Slightly inclosing these two apertures above is a widely-open V-shaped tegumentary fold, with its apex situated superiorly towards the root of the tail.

There are no *labia minora* visible; and no clitoris is present as a free organ, though the *corpora cavernosa* can be felt as tough bodies lying in the walls of the vulva.

The length of the urino-genital canal is 2·7 inches: about 1 inch from its external orifice may be seen, on each side of the middle line, two or three small pore-like depressions; a bristle passed through the largest of these enters a short duct, connected with one of a pair of globular compact glands about the size of a small cherry, which lie in the walls of the urino-genital canal above, between it and the rectum. They are, no doubt, "vulvo-vaginal" glands, or glands of Bertolini, corresponding to the male Cowper's. The urino-genital canal is lined by smooth, vascular, mucous membrane.

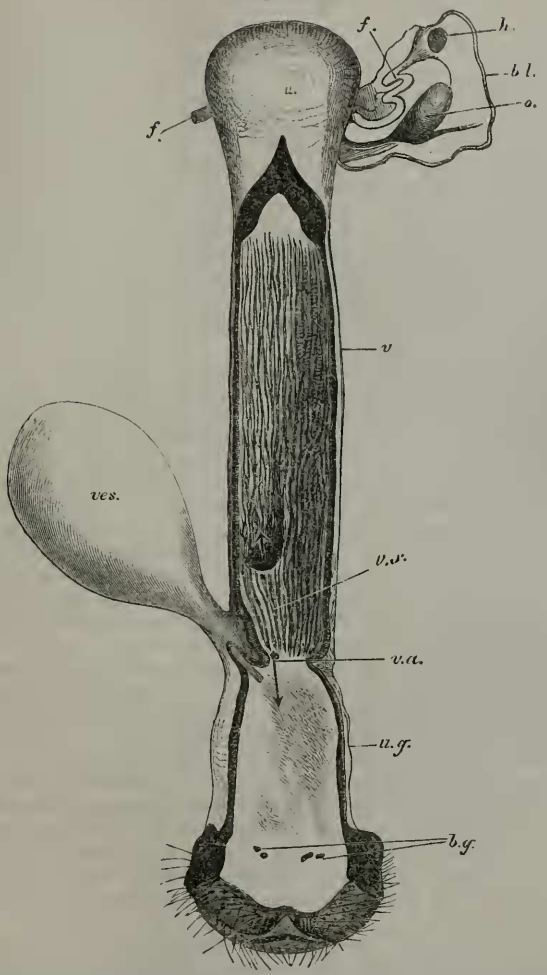
Communication between this and the next section of these organs is effected by means of two small apertures, each admitting readily enough the passage into the vagina, through the here constricted walls of the common tube, of a probe. From between these apertures is prolonged downwards, for a slight distance along the dorsal wall of the urino-genital canal, a slight ridge of mucous membrane, on each side of which are visible numerous small pore-like apertures, arranged in series in lines running outwards from the middle line.

On laying open the vagina along its anterior wall, it is seen to pass above with no marked constriction or "*os uteri*" into the pyriform simple uterus, the only distinction between the two parts being afforded by the thicker and more muscular walls of the uterus, and by the difference in the character of the mucous membrane, this being quite smooth and spongy in the uterus, whilst that of the vagina is thrown into a close-set series of thick, more or less longitudinal, somewhat foliaceous plaits. For about the lower inch of the vagina there extends a complete median septum, attached to both dorsal and ventral walls of the tube, extending a little further along the dorsal wall, and terminating superiorly by a free semilunar margin, concave upwards. Hence the terminal part of the vagina consists of two quite separate tubes, fused together above, but each opening into the urino-genital sinus by a single aperture of its own below.

The vagina proper measures about 4 inches in length. The pyriform uterus is not more than 2 inches long: it presents not the slightest sign of being double. Its walls are very thick and muscular;

[1] Mém. p. 194.

Fig. 6.



Female generative organs of *Myrmecophaga jubata*, from before, reduced, and somewhat diagrammatic. The walls of the tube have been laid open anteriorly to show the vaginal septum (*v. s*), beneath which an arrow is passed, appearing above in the vagina (*v*), and below emerging by the vaginal aperture of that side (*v. a*) into the urino-genital canal (*u.g*). The opening of the vagina into this on the other side is laid open.

b.g, openings of Bertolini's glands; *ves*, bladder, turned to one side; *u*, uterus; *f, f*, Fallopian tubes (cut short, with the rest of the uterine appendages on the left side); *o*, ovary; *h*, hydatid of Morgagni; *b. l*, broad ligament of the uterus, cut short.

but there is no constriction or valve at all at its junction with the vagina. It receives the Fallopian tubes, not at its supero-external angles as in *Homo* &c., but at a point about one third down its total length. These are not particularly long, nor much convoluted, and lie along the anterior edge of the broad ligament. The ovaries are completely covered by a peritoneal coat superiorly, but by their ventral faces open into a spacious peritoneal pouch, open anteriorly, in the floor of which is the very considerable aperture of the *morsus diaboli*, surrounded by the expanded extremity of the Fallopian tube. This is not much fimbriated, and is externally prolonged to meet the external border of the ovary of the same side. On this surface of the ovary may be seen a few scars, probably due to the eruption of Graafian follicles, as well as a couple of small clavate processes which depend freely from it into the cavity of the pouch. Towards the outer part of the broad ligament, and lying anteriorly to the ovary and round ligament, is a large "hydatid of Morgagni" nearly the size of a pea.

The opening of the vagina into the urino-genital sinus by *two* distinct apertures seems to be characteristic (according to the statements of Owen [1] and Rapp [2]) both of the Anteaters and the Sloths, though Pouchet considered it in his specimen as "sans doute une anomalie" (*l. c.* p. 195). The latter author describes as the "uterus" what I have here considered to represent both uterus and vagina, whilst what he calls "vagina" is only so in a functional sense, being morphologically the urino-genital canal. Rapp also describes these animals as having a single uterus with two *ora* ("*einfache Gebärmutter mit doppeltem* (*rechten und linken*) *Muttermund*," *l. c.* p. 104). Nevertheless I see no reason for doubting the view adopted by Prof. Owen, that the genital tube above the urethral opening represents in reality both uterus and vagina.

The presence of a vaginal septum, a remnant of the coalescence of the primitively paired Müllerian ducts, in *Myrmecophaga* is a peculiarity shared, judging from Owen's account, by the genus *Choloepus* [3] only amongst other families of Edentates.

In the Indian Elephant there is, at least sometimes, a similar but more perfect septum dividing into lateral halves not only the vagina, but the uterus (here provided with a distinct *os uteri*) also [4]. In other cases this disappears completely, except externally, forming then the so-called "hymen" of Miall and Greenwood.

In the genus *Lagostomus*, on the other hand, as first described by Prof. Owen [5], the accuracy of whose statement I have lately had an

[1] Anat. Vert. iii. p. 690. [2] *L. c.* p. 102.

[3] "In the Unau (*Bradypus didactylus*) the rudiment of a uterine septum appears as a longitudinal ridge from the inner surface of the anterior wall in the unimpregnated state: in this species also the same condition having been already noted in *Bradypus tridactylus*], the utero-vaginal canal communicates in the virgin animal by two distinct orifices with the short urogenital tract." Anat. Vert. iii. p. 690.

[4] M. Watson, "On the Anatomy of the Female Organs of the Proboscidea," Trans. Z. S. xi. p. 116 &c. pl. xxii. fig. 1.

[5] P. Z. S. 1839, p. 177; Anat. Vert. iii. p. 686.

opportunity of verifying, this median septum is developed along the proximal (uterine) part of the vagina, instead of the distal (external) as in *Myrmecophaga*[1].

As Pouchet, though describing the two apertures, does not mention any median septum, it is possible that this vaginal septum may disappear, as there seems to be good reason for supposing that it does in *Elephas indicus*, in the gravid state. The penis in *Myrmecophaga* is so small that during coitus it is, I expect, entirely contained in the urino-genital tube, and does not enter the vagina, as is also the case in *Elephas*; the disappearance of the vaginal septum can therefore hardly be due, in this species at least, to the non-*virgin* condition of any particular female.

4. As regards other points, I may mention that the external and internal iliac arteries come off separately, as in many other mammals[2], there being no common iliac arteries.

As in *Manis tridentata* as described by Rapp[3], the chevron bones in the tail contain a curious caudal *rete mirabile*, composed of both venous and arterial elements, which completely surrounds, as in a sheath, a central artery of large size, which is the direct continuation onwards of the abdominal aorta, and gives off here no branches at all to the *rete*. The arterial elements of this *rete* are derived from several small trunks on each side, which arise from the caudal artery beyond the origin of the internal iliacs, and then break up into a number of more or less parallel, rarely anastomosing, branches, mixed up with which are similar venous trunks. A similar *rete* occurs in *Tamandua*, and also, as I am informed by Prof. Flower, in the Spider Monkeys of the genus *Ateles*.

The paired eyelids are very small, and hardly exist as special organs; there are no eyelashes. The third eyelid, on the other hand, is very large and well-developed. It contains a large cartilage of concavo-convex shape; on the internal surface of this eyelid, just below the inferior border of the contained cartilage, opens the minute aperture of the Harderian gland, which is very large, almost completely surrounding the orbit, and concealing the much more minute lachrymal gland. As described and figured by Pouchet, it consists of three chief lobes.

As already suggested by Chatin, I have little doubt that it is the Harderian gland that has been described by Cuvier (Anat. Comp. 2me éd. iv. part 1, pp. 430, 431) and Owen (*l. c.* pl. xl. fig. 3 *b*) in *Cycloturus* as a salivary gland opening into the mouth.

Clavicles are frequently supposed to be absent in the Great Ant-

[1] A similar condition of things to that here described in the genus *Myrmecophaga* occurs sometimes, it may be observed, as a malformation, known as "*vagina duplex et uterus simplex*," in the human female, the vagina being more or less completely divided into two chambers by a median septum, and opening externally by *two* quite separate orifices. *Cf.* a paper by Dr. T. Matthews Duncan, Journ. Anat. Phys. i. pp. 269–274, and Dr. Morrison Watson's paper, "The Homology of the Sexual Organs illustrated by Comparative Anatomy and Pathology," *l. c.* xiv. pp. 60–62.

[2] *Cf* P. Z. S. 1881, p. 188.

[3] *L. c.* p. 92.

eater, though present as rudiments in *Tamandua*, and well developed in *Cycloturus*[1].

In the larger specimen of the two examined by me I find, however, a distinct one present on each side, lying in the muscles, about an inch long, nearly straight, of flattened form, with one end cylindrical. Similar ones were also present, closely attached to the sternum, but of smaller size, in the second specimen. Rapp (*l. c.* p. 40) found a rudimentary cartilaginous one in *Myrmecophaga*, though he (erroneously) denies one to *Tamandua*. There is also an accessory ossicle developed at the head of the fibula, as in some of the fossil forms.

In the anterior *cornu* of the hyoid bone, I find in both specimens *three* distinct ossifications[2]. The proximal of these is a small nodule of bone, ·3 inch long, articulating below with the basihyal; it is called the "apohyal" by Pouchet, but, according to the nomenclature now ordinarily employed, must really be the cerato-hyal[3]. The other two long curved ossifications of the anterior *cornu* must therefore be the epi- and stylo-hyals respectively.

Both Rapp (*l. c.* p. 61) and Pouchet ('Mémoires,' p. 95, pl. xii. figs. 1–3) describe the posterior cornu as articulating externally with the anterior one. But in neither of my specimens can I find any evidence of such a joint, as the two *cornua*, when in their undisturbed condition, are separated by a considerable space, in part occupied by a muscle (the *intercornualis*, Owen, *l. c.* p. 127); and in the cleaned bones I also find it impossible, without violence, to bring the two arches into such contact together. In *Tamandua*, though there is a distinct ligament between the two arches, they are nevertheless similarly separated; and neither Duvernoy[4], who dissected this species, nor Owen, in his account of *Myrmecophaga*, allude to any such interarticulation existing; Owen's figure (pl. xxxix. fig. 2) indeed clearly shows the two cornua separated by the *intercornualis* muscle, as also observed by me (*cf.* Plate XV. fig. 1, *int*).

At the place where the three main ducts of the submaxillary glands of each side converge to become intimately connected together by their walls, though they still remain quite separate tubes, they are covered by a mass of muscle which forms a bulb-like swelling for an extent of $1\frac{3}{4}$ inch on the inferior aspect of the conjoined ducts (Plate XV. fig. 1). It is this mass of muscles that has been described by Owen (*l. c.* p. 126) as the "*constrictor salivaris*," a name adopted by Pouchet subsequently.

The external aspect of the ducts is also, for the posterior half inch of this space, covered by a thick muscular coating, so that in this portion the three ducts are encircled by a broad ring of muscular fibres. These fibres arise from the anterior edge of the anterior hyoid cornu, on each side of the junction of the stylo- and epihyal

[1] 'Osteology of the Mammalia,' by W. H. Flower, p. 235: London, 1876.

[2] The accounts given by different authors of the compositon of the hyoid bones in the Anteaters differ considerably *inter se*. *Cf.* Pouchet, 'Mémoires,' pp. 93–95.

[3] In *Tamandua* I am unable to find any corresponding ossification, though both the epi- and stylo-hyals are well developed.

[4] Mém. Soc. Hist. Nat. Strasbourg, 1830; and Cuvier's Anat. Comp. 2me éd. iv. part 1, p. 476.

bones; running then forwards and outwards, they pass *beneath* and to the outside of (in a sternal view) the conjoined ducts, and then ascend to fan out and form the muscular bulb. The more anterior of these fibres are inserted into the internal and upper part of the combined ducts, and cease there. The most posterior, on the contrary, completely encircle the ducts, running inwards over the ducts, and then, recurving on themselves, ascend on the deep aspect of the ducts, to be inserted on the stylohyal bone for the greater part of its length, not, however, extending to either of its extremities. Along the anterior (free) border of the ascending part, at the point where it is in contact with the ducts and the deep part of their muscular ring, is developed a strong tendinous edge (*s.h. m. t*), the "commissural tendon" of Owen.

The muscular fibres inserted on this and attached to the stylo-hyal (ceratohyal of Owen's nomenclature) are described by that author as the "*cerato-hyoideus*," whilst Pouchet more correctly applies to it the name of "*stylo-hyoideus*," the rest of the muscular arrangement here described forming, as already stated, the "*constrictor salivaris*" of both authors.

It appears to me that the whole muscle may be more correctly considered as the *stylo-hyoideus*, which has developed this remarkable course round the submaxillary ducts in order to aid the ejaculation of the saliva therein contained by the constriction, on contraction of the muscle, of their walls between the circularly-disposed fibres surrounding them and the tendon developed on its anterior margin.

In the genus *Tamandua*[1] (Plate XV. fig. 2) there is no special muscular envelope developed round the ducts in this position. The most posterior fibres of the *mylo-hyoideus* (*m.h'*) arise from the posterior end of the stylo-hyal bone, running inwards and forwards, and blending internally with the genio-hyoid. To this point also run *backwards* and inwards the fibres of a narrow flattened muscle (*s.h. m*), which crosses the hyoid origin of the mylo-hyoid superficially, and, as it arises from the stylo-hyal bone, must be considered to represent a *stylo-hyoideus*. At the point where it meets the genio-hyoid and mylo-hyoid, all three muscles become closely connected together, the stylo-hyoid developing here an anterior tendinous edge (*s.h. m. t*). Between this tendon and the conjoined mylo-hyoid and genio-hyoid run the three ducts of the submaxillary gland, so that contraction of these muscles here also serves a purpose similar to that produced by the more specialized arrangement found in the larger species.

[P.S. July 13, 1882.—I have found the disposition of the salivary ducts and the arrangement of the *stylo-hyoideus* muscles exactly the same as those here described in a third specimen of *Myrmecophaga* just dead.—W. A. F.]

EXPLANATION OF PLATE XV.

Fig. 1. Dissection of the left suprahyoidean region of *Myrmecophaga jubata*, to show the course and relations of the *stylo-hyoideus* muscle.

[1] *Cf.* Duvernoy, Mém. Strasb. 1830, "Mémoire sur la langue" &c., p. 3.

s.h. stylo-hyal; *e.p*, epihyal; *c.h*, cerato-hyal; *b.h*, basihyal; *t.h*, thyro-hyal; *s.h.m'*, origin of the *stylo-hyoideus*; *s.h.m*, its insertion; *s.h.m.t*, its tendinous edge (this, being deep of the muscle and ducts, is diagrammatically represented by a dotted line); *m.h*, *m.h'*, *mylo-hyoideus*, cut and reflected; *s.g*, *sterno-glossus* (cut short); *g.h'*, *genio-hyoideus*, at its origin, cut short and reflected; *h.g*, *hyo-glossi*; *ep*, *epipharyngeus* (Owen); *hy*, *hypopharyngeus* (Owen); *int*, intercornualis; 1, 2, 3, the three ducts of the submaxillary gland, converging to be surrounded by the *stylo-hyoideus*.

2. The same parts in *Tamandua tetradactyla*, enlarged. The letters as before, except *s.h.m*, *stylo-hyoideus* muscle, with its anterior tendinous edge (*s.h.m.t*), blending here with the mylo-(*m.h.*) and genio-hyoid (*g.h*) muscles, and surrounding the three submaxillary ducts (*s.m.d*), which are cut short and reflected; *m.h'*, hyoid origin of the mylo-hyoid.

3. Diagram to show the openings into the mouth of the three ducts of the submaxillary gland in *Myrmecophaga*. *a*, *b*, the two ducts from the more posterior parts of the gland, opening together; *c*, the third duct, from the cervical part, opening posteriorly to the other two ducts.

2. List of the Birds sent home by Mr. Joseph Thomson from the River Rovuma, East Africa. By Captain G. E. Shelley.

[Received February 25, 1882.]

(Plate XVI.)

Mr. Thomson is well known as one of the most successful East-African explorers. On him devolved the task of carrying through the expedition in which Mr. Keith Johnston lost his life; and no praise can be too strong for the manner in which he fulfilled his mission. Like all successful African travellers, he has again returned to the Dark country, this time to explore the river Rovuma and to report on the value of the coal-fields said to exist in that valley; and an interesting account of his journey has been given by himself (Proc. R. Geogr. Soc. 1882, p. 65).

The Rovuma runs from the south-west into the sea at 10° 30′ S. lat.; and Mr. Thomson explored this valley to nearly 37° E. long. During this journey the present collection of birds was made, whereby two interesting new species are added to the African Avifauna.

1. Astur tachiro (*Daud.*).
2. Falco minor, *Bp.*
3. F. dickersoni, *Sclat.*
4. Coracias caudata, *Linn.*
5. Halcyon orientalis, *Peters.*
6. Merops dresseri, sp. n.
7. Melittophagus bullockoides (*Smith*).
8. M. pusillus (*Müll.*).
9. Upupa africana, *Bechst.*
10. Irrisor erythrorhynchus (*Lath.*).
11. Rhinopomastes cyanomelas (*Vieill.*).
12. Cinnyris microrhynchus, *Shelley.*
13. C. gutturalis (*Linn.*).
14. Motacilla vidua, *Sundev.*
15. Turdus libonyanus, *Smith.*
16. Cossypha heuglini, *Hartl.*
17. Crateropus plebejus (*Rüpp.*).
18. Oriolus notatus, *Peters.*
19. Pachyprora molitor (*Hahn & Kust.*).
20. Bias musicus (*Vieill.*).
21. Platystira pellata, *Sundev.*
22. Muscicapa cærulescens, *Hartl.*
23. Erythrocercus thomsoni, sp. n.
24. Trochocercus cyanomelas (*Vieill.*).
25. Smithornis capensis, *Smith.*
26. Parus niger, *Vieill.*
27. Melanornis ater, *Sundev.*
28. Buchanga assimilis (*Bechst.*).
29. Telephonus erythropterus (*Shaw*).
30. Laniarius cubla (*Shaw*).
31. L. boulboul (*Shaw*).